Physician-Owned Specialized Facilities: Focused Factories or Destructive Competition? A Systematic Review.

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ABSTRACT

Multiple studies have investigated the business case of physician-owned specialized facilities (specialized hospitals and ambulatory surgery centers). However literature lacks integration. Building on the theoretical insights of disruptive innovation, a systematic review was conducted to assess the evidence base of these innovative delivery models. The Institute of Medicine's quality framework (safe, effective, equitable, efficient, patient-centered and accessible care) was applied in order to evaluate the performance of such facilities. In addition the corresponding impact on full-service general hospitals was assessed. Database searches yielded 6,108 candidate articles of which 47 studies fulfilled the inclusion criteria. Overall the quality of the included studies was satisfactory. Our results show that little evidence exists in support of competitive advantages in favor of specialized facilities. Moreover even if competitive advantages exist, it is equally important to reflect on the corresponding impact on full service-general hospitals. The development of specialized facilities should therefore be monitored carefully.

Key words: specialty hospital, ambulatory surgery center, physician ownership, disruptive innovation, focused factory, systematic review.

INTRODUCTION

In response to pervasive deficits in quality of care (i.e. Mc Glynn et al., 2003) and skyrocketing health care expenditures (OECD, 2012) pressures to provide better and more efficient care continue to shape health care management and policy debate. Besides changing the payment framework and the associated incentives (e.g. pay for quality initiatives), policymakers and providers have turned their attention to the way care is delivered. More specifically an increasing part of care historically delivered at the hospital inpatient setting can now be conveniently performed in a short-stay or even the ambulatory setting. Consequently, besides the traditional full-service general hospital, specialized facilities have emerged as alternative settings of care delivery. These specialized facilities are typically defined as hospitals that treat patients with specific medical conditions or those in need of specific medical or surgical procedures, most notably orthopedic, spine, cardiac and surgical procedures (Mitchell, 2007; Schneider et al., 2008). Several types of specialized facilities have been described and a distinction has been made between facilities that focus on the ambulatory setting and hospitals that specialize in certain inpatient procedures. The former are ambulatory surgery centers (ASCs), described as freestanding outpatient facilities, dedicated to provide a specialized service such as cataract repair or colonoscopy (Meyerhoefer, Colby & Mc Fetridge, 2012). The latter are specialty hospitals (SH) which are licensed hospitals, typically small with approximately 20 beds (Badlani, Boden & Phillips, 2012). Examples of procedures performed in these hospitals are coronary artery bypass grafting and total knee replacement. Virtually all these specialized facilities are for-profit and approximately 83% of surgery centers in the U.S. are wholly or partly owned by physicians (Gabel et al., 2008; Lynk & Longley, 2002; Mitchell, 2007; Strope et al., 2009).

Both types of these specialized facilities have been the subject of intense debate (Casalino, Devers & Brewster, 2003) and in recent years, a lot of research has been published

on this theme. However, the literature lacks a clear and systematic view on the extent to which potential improvements in terms of quality and cost of care are realized. In addition the feasibility is unclear when the corresponding impact on full service-general hospitals is taken into account.

Proponents argue that these specialized facilities are 'focused factories' with associated economies of scale and scope (Schneider et al., 2008) and therefore can be considered as 'disruptive innovations' improving health care delivery (Christensen, 1997; Christensen, Grossman & Hwang, 2009). This potentially lowers the cost of health care delivery and possibly enhances quality of care by concentration of the expertise associated with the increased specialization (Casalino, Devers & Brewser, 2003). For example, the Shouldice clinic in Ontario Canada has been subject to a Harvard Business School case-study because of its focused model of care delivery (hernia repair) which is associated with higher quality and lower overall costs **(**Hallowell & Heskett, 2004). As most of these specialized facilities are physician-owned this element has been argued to improve quality of care (Ford & Kaserman, 2000) by reinforcing the physician professional role as the primary enforcer of quality of care. Moreover, this line of thought advocates specialized facilities as patient-centered and physician-friendly organizations (Badlani et al.,2012).

Critics contend that physician ownership associated with specialized facilities presents a major potential conflict of interest. Financial incentives linked to ownership have the potential to affect physicians' practice patterns. Physicians with an ownership stake generate professional fees for performing their medical duties, but are also entitled to share facility fees generated by the center in which they have invested. This changes the financial incentives for physicians. Therefore it can be argued that with a facility ownership stake some physicians may lower thresholds for treatment thereby increasing the utilization of procedures (Mitchell, 2008) and focusing to a higher degree on well-insured patients (Cram, Pham, Bayman &

Vaughan-Sarrazin, 2008). Furthermore there is the possibility that these specialized facilities treat primarily low-acuity patients within DRGs that are more profitable and send clinically complex cases to full service general hospitals (Mitchell, 2005). Concerns rise because hospitals are then left with the care for the poor or underinsured population and the most complicated onerous cases. This potentially undermines the current business model of full-service hospitals endangering their financial viability. Finally, the asymmetric obligation to assure 24/7 emergency call for full service general hospitals combined with a shrinking physician workforce has emerged as a major challenge to hospitals and has led to an unequal struggle (Casalino, Lawrence, November, Berenson & Pham, 2008).

The aim of this review is to assess and summarize the current evidence related to SHs and ASCs. Although the idea of a focused factory seems valuable and theoretically the benefits are high, the question remains if these advantages are really realized. We investigate if the formulated concerns are justified and whether the benefits outweigh the potential side-effects. The opposing views depicted above have manifested themselves in two distinct policy perspectives. If competition from these specialized facilities has social benefits, then policy makers should allow, and even facilitate, their entry. If competition from specialty hospitals is undesirable than policy makers should set regulations and financial incentives to account for the negative external effects that these facilities create (Barro, Huckman & Kessler 2006).

New contribution

Internationally, physician-owned specialized facilities and equity ownership has become an important issue of debate. Despite the increasing popularity of these facilities, to the authors' knowledge, no systematic evaluation of the current evidence base has been conducted yet. In recent years, a lot of research has been published on this theme but the literature lacks synthesis and integration. Since there has been no attempt to synthesize and integrate current systematically knowledge our study goes beyond previous work. Furthermore, the heterogeneity in clinical setting (i.e. urology, orthopedic surgery), procedures (i.e. knee and hip surgery) and methodology (i.e. longitudinal and cross sectional studies) suggests a need for reviewing the literature systematically. Additionally, most previous studies do not explain their findings through the application of theory. Our study fills this research gap by building on the theory of disruptive innovation (Christensen, 1997, Christensen et al., 2009). The results are intended to inform health policy makers, third party payers and health care providers as well as to formulate priorities for further research.

Conceptual framework

Physician-owned specialized facilities can be seen as focused factories or a special case of a disruptive innovative model of health care delivery. Theoretical approaches that explain this emerging model of disruptive innovation may serve as a useful conceptual framework to understand the case of specialized facilities. The theory of disruptive innovation has created a significant impact on the development of new business-models and aroused plenty of rich debate within practice and academia (Dan & Chang, 2010). Disruptive innovations, as developed by Christensen, 1997 and Christensen et al., 2009, are considered to be innovations that disrupt an existing market thereby improving health care delivery. An overview is depicted in figure 1.

Insert Figure 1 about here

At the basis of the innovative model lies a technological enabler (1) that is translated into a new delivery model (2) characterized by lower-cost, higher-quality or more accessible services. The delivery of medical care has been historically frozen into two dominant business models, the full service-general hospital and the physician practice. However, both models were designed a century ago, when the nature of medicine was very different from modern health care. Due to developments like minimal invasive surgery, improved anesthetics and diagnostic possibilities, hospitals have shifted their focus from patient recovery in a nursing ward to highly technological medical care with a limited length of stay. This evolution raises the question whether the current business models of general hospitals and physician practises are still the most cost-effective way of health care delivery. The third important enabler of disruption innovations is the coalescence of an independent value network (3) around the new disruptive business models through which care is delivered. The new business-model needs to be knit together in a value network leading to added value for the system as a whole. While technological advancements may contribute to improved care, the greatest opportunities to improve the care provided to the population are to focus on and modify the health care delivery system currently in place (Hansen & Bozic, 2009). Finally, the impact of regulation should be considered (Curtis & Schulman, 2006). This aspect is a central component of disruptive innovation theory and coincides with the ultimate goal of our paper: enabling evidence based policy making (4) by synthesizing and integrating the available scientific evidence. We use the six dimensions of quality of health care (5) identified by the Institute of

Medicine (safe, effective, equitable, efficient, patient-centered and accessible care) that are considered to be overarching principles that help to provide specific direction for policymakers and providers to implement change and improve health care (Institute Of Medicine, 2001). Since the interaction with the delivery system in place is not fully covered by the described dimensions (Health Services Research Group, 1992), the added value for the entire secondary care delivery was added to our assessment framework. Moreover, physician-owned specialized facilities have been criticized for undermining the business model of full service-general hospitals due to asymmetric obligations (Shactman, 2005) and deteriorating hospital-physician relationships (Goldsmith, 2007). Therefore, this dimension can be considered to be important as well. Table 1 provides a definition of the different dimensions.

Insert Table 1 about here

METHOD

This study draws upon the analysis of literature from the systematic review perspective. The databases Embase, Pubmed, Cinahl, PsychInfo, Web Of Science, Eric and the Cochrane Library were searched for relevant studies. The searches were conducted in October 2012 (Week 40). Two reviewers independently searched for relevant studies using a standardized search strategy. The concepts of specialized facilities and the different dimensions of quality of care (explained above) were combined into a standardized search string using MesH and non-MeSH entry terms "[(ambulatory care center* OR ambulatory surgery center* OR outpatient clinic* OR surgicenter* OR specialty hospital*) AND ("Treatment Outcome" OR "Safety" OR "Health Services Accessibility" OR quality OR

outcome* OR error* OR safety* OR access* OR equity OR effectiveness OR continuity OR practice pattern*) AND (ownership* OR Salaries and Fringe Benefits OR Reimbursement OR Incentive OR compensation* OR reimbursement* OR financ* OR bonus* OR remunerat*)]. The initial search strategy was validated using a selection of key papers known to the authors.

Inclusion and exclusion criteria

The following criteria were applied:

1. Only studies written in English were eligible.
2. Studies published in peer-reviewed journals between January 2000 and October 2012 were included. This time frame was selected because in this period physician-owned SHs and ASCs have emerged (Al-Amin & Housman, 2010).
3. Empirical quantitative studies were included. Qualitative research, commentaries, and theoretical analysis were excluded.
4. Single center studies were excluded.

Data extraction

Two reviewers searched independently for relevant studies using the standardized search strategy described above. The selection of the studies was determined in a two-step procedure. First, the search results were filtered by title and abstract and then narrowed down according to the formal inclusion and exclusion criteria. These were mainly duplicate records and references to non-empirical studies. The remaining studies were selected for full-text retrieval and underwent critical quality appraisal. In case of non-corresponding results, consensus was sought by consulting a third reviewer. In addition the reference lists of relevant publications were screened and forward citation track was applied. Comparison of the analysis results of the two reviewers identified five non-corresponding primary publications out of 6,108

potentially relevant publications (Cohen's Kappa: 94,1%). We did not perform a meta-analysis because the selected studies had a high level of heterogeneity in the applied methodology and outcome measurements.

Quality appraisal

Following Leonard, Stordeur & Roberfroid (2009) a global and pragmatic unweighted score was issued for each paper (high (H), medium (M) or low (L) quality). All relevant studies were appraised by ten generic items: clear description of the research question, patient population and setting, intervention, comparison, effects, design, sample size, statistics, generalizability and the addressing of confounders (Van Herck et al, 2010). Table 2 provides an overview of the applied criteria.

Insert Table 2 about here

RESULTS

Description of studies

Our literature search initially yielded 6,108 unique candidate articles, of which 112 were selected for full-text retrieval (figure 2). The references of these studies were searched to collect additional studies which were not included in the records identified through our database search. In this way, 20 additional studies were included. On the basis of abstract review, 75 articles (67 articles originating from our database search and 8 articles identified by our check of the references of the included articles) did not meet the inclusion criteria and were excluded for further review. After this step, the 57 references appearing to meet the study eligibility criteria were reviewed thoroughly. Ten papers deemed ineligible (single center case studies and qualitative studies) resulting in a final sample of 47 studies included in the review.

Insert figure 2 about here

Almost all the studies originated from the United States. We retrieved only one European study (Denmark). A considerable increase in studies meeting the inclusion criteria published during the past years can be observed. Most reviewed articles obtained data of ASCs (21/47) or SHs (23/47). One study included both ASCs and SHs. Two studies referred to small private clinics but addressed the research question under study. Overall, the quality of the studies was apprized as satisfactory. About half of the included studies (23/47) were rated high, 40% (19/47) rated medium and 11% (5/47) were considered low. It should be noted that many of the included studies used convenience samples (i.e. Medicare data) and the

adjustment for confounding factors (i.e. sex, age, insurance status) varied across the included studies. Studies varied by a number of characteristics (table 3). First, the clinical field of the study differed across the included studies. Whereas the majority of studies focused on orthopedics (i.e. total hip prosthesis, carpal tunnel release and arthroscopic surgery of the knee) and cardiac care (coronary artery bypass grafting, percutaneous coronary artery intervention) other studies investigated SHs and ASCs in the clinical area of oncology, urology, spine surgery, eye surgery and colonoscopy.

Second, multiple outcome measures were used. While most studies focused on the extent to which physician-owned specialized facilities might impact effectiveness (i.e. clear indications), efficiency (i.e. cost) and safety (i.e. mortality) of care, we also found studies examining the effect on equity (adverse selection of the poor and uninsured population) and patient centeredness (i.e. patient satisfaction). Remarkably, while accessibility is considered a conceptual and theoretical argument in favor of specialized facilities we did not retrieve a single study focusing directly on this issue. Finally, the effect of specialized facilities on full service-general hospitals (the impact on the health care value network) was studied frequently.

Insert table 3 about here

Effect findings

Safety

A total of 11 publications that assessed safety of care were identified. Mortality and readmission rates were studied most frequently as safety outcomes. Several studies found a

lower mortality rate (Cram, Rosenthal & Vaughan-Sarrazin, 2005; Chukmaitov, Menachemi, Brown, Saunders & Brooks, 2008; Cram, Bayman, Popescu & Vaughan-Sarrazin, 2010; Greenwald et al. 2006) and readmission rate at specialized facilities (Chukmaitov, Devers, Harless, Menachemi & Brooks, 2011; Cram, Vaughin-Sarrazin, Wolf, Kats & Rosenthal, 2007; Hollingsworth et al, 2012). However, in case of the latter the results of Greenwald et al. (2006) showed that this is not always the case. Although patients treated at orthopedic SHs had lower readmission rates among the moderate-severity admissions, readmissions were higher among patients treated at cardiac specialty hospitals, in particular for the severe category. Besides mortality and readmission rates, Hollingsworth et al. (2012) and Cram et al. (2007) investigated the occurrence of postoperative complications. Both studies concluded that patients experienced fewer postoperative complications at ASCs and specialized hospitals (e.g. postoperative sepsis, postoperative hemorrhage).

However, it is important to note that safety advantages seem to disappear when these outcomes are adjusted for patient characteristics and procedural volume. Patient characteristics are clearly important since patients treated in general hospitals have been found to have higher average risk scores (Meyerhoefer et al, 2012; Winter 2003, Mitchell 2005, Cram et al. 2007), cases are characterized by a higher medical complexity (Cram et al. 2010, Chukmaitov et al. 2008) and treat less healthier patients (Barro et al. 2006; Cram et al. 2005, Hollingsworth et al. 2012). Furthermore, evidence was found in support of volume-safety relationships (Barker, Rosenthal & Cram, 2011; Chukmaitov et al., 2011, Cram et al. 2005) demonstrating that higher volumes of treated cases sometimes improves safety of care delivery.

Effectiveness

Our review identified 13 articles addressing care effectiveness. Two subthemes emerged. On the one hand, the adherence to clinical guidelines and evidence based quality measures was investigated. Andersen & Jakobsen (2011) showed that, from a clinical perspective, patients receive the same treatment in SHs as in general hospitals for hip operations. This was confirmed by Popescu, Nallamothu, Vaughan-Sarrazin & Cram (2008) claiming that compliance to evidence-based treatment guidelines in SHs were similar to other top-ranked hospitals. This contrasts the finding of Cram et al. (2011) who showed that SHs perform more percutaneous coronary interventions for unclear indications.

On the other hand, the financial incentives introduced by physician ownership of specialty hospitals have been studied. Several studies showed that incentives linked to ownership coincided with an increase of procedures on a hospital level (Hollingsworth et al., 2009, 2011; Mitchell, 2008, 2010, 2012 and Yee, 2011). In addition, evidence is available that adjusted population based rates of procedures performed in areas with high market share for ASCs were manifest (Hollenbeck, Hollingsworth, Dunn, Ye & Birkmeyer, 2010), growth rates were higher (Stensland & Winter, 2006) and the entry of SHs in a region substantially increased market utilization rates (Mitchell 2007; Hollingsworth et al., 2011; Nallamothu et al., 2007).

These results suggests that the ownerships stakes of either specialized hospitals or ASCs do influence physician practice patterns. Specifically, the frequency of use of surgery, diagnostic and ancillary services increased after physician ownership was established. These findings demonstrate that the threshold to perform medical procedures is lowered by the introduction of ownership stakes and supply-induced demand is thereby increased.

Equity

Equity was studied in 9 articles focusing on potential differences in race, gender, insurance status of the treated population and levels of uncompensated and charity care.

Gabel et al. (2008) and Greenwald et al. (2005) studied the insurance status of the patients referred to ASCs and found that physician-owners refer well-insured patients to their facilities and less insured (i.e. Medicaid patients) to general hospital facilities. What is more, Mitchell (2005) and Tan, Wolf, Hollenbeck, Ye & Hollingsworth (2011) found that specialty hospitals treated higher percentages of cases with generous or private insurances. In addition, black patients (Nallamothu, Lu, Vaughan-Sarrazin, & Cram, 2008; Cram, Vaughan-Sarrazin & Rosenthal, 2007, Cram et al, 2010) and women (Cram et al., 2010; Hollingsworth 2012) were less likely to be cared for in ACSs and SHs.

Specialty hospitals provide less uncompensated care (Greenwald et al., 2006). Similarly, uncompensated and charity care in general hospitals was affected downwards after entry of cardiac SHs, this however was not the case for orthopedic and surgical specialty hospitals (Carey, Burgess & Young, 2009).

Efficiency

In general, specialized facilities have been argued to be more efficient than competing full-service general hospitals. However, to date, the scientific evidence supporting this claim is scarce when costs of care are compared. Efficiency was addressed by only 2 studies. Carey, Burgess & Young (2008) studied costs of full-service general hospitals and physician-owned cardiac, orthopedic and surgical specialty hospitals. They found no lower costs and thus evidence for increased efficiency in favor of specialty hospitals. On the contrary, in case of orthopedic and surgical specialized facilities it was found they exhibit higher levels of overall

cost inefficiency. This can be explained by competition is in part driven by cost-increasing services and technology. In case of cardiac care this difference was not present.

In addition, Hair, Hussey & Wynn (2012) assessed potential differences in operational performance. Their main outcomes were perioperative times as a proxy for hospital efficiency. Surgery time, operating room time and postoperative time were significantly shorter in ASCs. However it is important to note that clinical outcomes were not considered in this study and an unequal basis of comparison could be present.

Patient-centeredness & Accessibility

Evidence regarding the dimensions of patient-centeredness and accessibility was limited to only one quantitative study. Andersen et al. (2011) studied the time between referral and preliminary examination and time between decision and procedure. This study showed that in Denmark, private clinics had shorter waiting times than public clinics for both preliminary examinations and actual surgery. They also found higher patient satisfaction scores in private clinics. Although it can be argued that specialty hospitals target unmet demand, no evidence was found that access increased in market where specialty hospitals emerged.

Value network

While the different dimensions depicted above focus on the possible differences in performance of hospitals, it is equally important to measure the corresponding impact of specialized facilities on full-service general hospitals and thus the added value for the system as a whole. This issue emerged in our systematic literature review as a major issue and frequently studied topic. We identified 18 articles focusing on this aspect.

Competitive effects

A central argument in the debate of specialized facilities is the potential effect of specialized facilities in promoting healthy competition with other full-service general hospitals, thereby enhancing performance. Indeed ASCs have been more likely to enter markets with lower or insufficient levels of competition among hospitals (Bian & Morrisey, 2006). However emperical results suggests that general hospitals, when confronted with competition from specialized facilities, step up their own offering of services. This was found by Carey, Burgess and Young (2009a) in case of cardiac services and high technology diagnostic imaging. These researchers also examined differences in offerings of safety-net services (i.e. emergency department and trauma center). They found mixed and inconsistent results. While trauma centers and burn units were positively associated with competition this was not the case for emergency care and crisis prevention. In the field of cardiology they found that a general hospital located in the same market will add angioplasty or cardiac catheterization within two years post entry of specialty hospitals. Results also indicate that hospitals located in markets with orthopedic or surgical specialty hospitals raise their nursing staffing levels (Carey, Burgess & Young, 2009b). Schneider et al. (2007) found that entry of specialized hospitals encourages greater cost efficiency on the part of incumbent hospitals. Hospital operating margins were improved by reducing full service general hospital costs.

Patient characteristics and volume

First, research indicates that volume was shifted from general hospitals to physician-owned specialized facilities only to a limited degree (Bian & Morrisey, 2007; Courtemanche & Plotzke, 2008; Hollingsworth et al. 2012). Second, this shift concentrated primarily on low-severity cases which correspond with more profitable diagnostic related groups (Mitchell 2005; Plotzke & Courtemanche, 2011; Strope et al., 2009) and lower cost risk (Meyerhoefer

et al, 2012). Cohesively, evidence was found that SHs treat a greater share of healthier patients (Barro et al. 2006; Cram et al. 2005, Hollingsworth et al. 2009) with less comorbid illness (Cram et al. 2010, Chukmaitov et al. 2008). However, the market of secondary care as a whole has grown. Therefore clear evidence of a decline in volume or an increase in patient case complexity for general hospitals is absent (Lu, Hagen, Vaughan-Sarrazin & Cram, 2009; Hollingsworth et al., 2012). Whereas the studies of Bian & Morrisey (2007) and Couremanche & Poltzke (2008) depicted similar results for inpatient procedures, they did find a decrease in hospital outpatient volume.

Third, while physician-owners tend to focus more on cases with generous insurance (Mitchell, 2005) and financially, lucrative procedures (Strope et al., 2009), we did not find evidence of a corresponding impact on full service general hospitals.

Financial effects

The effects of increased competition, changes in patient volume and –characteristics could possibly have a negative effect on full service-general hospital financial health. Cimasi, Sharamitaro, Haynes & Seiler (2008) did not find conclusive evidence of the negative impact of specialized facilities on overall hospital profitability. Carey, Young & Burgess (2011) found that this nevertheless has led to revenue losses and decreased margins. In the long run, hospitals tend to exit markets with high ASC density (Al-Amin & Housman, 2010) and specialized facilities founding rate is related to the closure of general hospitals (Al-Amin, Zinn, Rosko & Aaronson, 2010). This contrast with the findings of Schneider et al. (2008) which question the contention that competition from specialized facilities harms general hospitals financially. Hospital operating margins were improved by a reduction in general hospital costs.

DISCUSSION

Theoretically, it can be argued that physician-owned specialized facilities have certain characteristics that may give them a competitive advantage compared to general hospitals. The focus on a limited number of procedures enables them to realize economics of scale and economies of scope, which could contribute to increased efficiency and quality of care (Schneider et al., 2008). However the results of our systematic review shows that the results of previous empirical studies are mixed and inconclusive. This finding supports the argument that comparing hospital performance is highly complex and inadequate measures of costs and quality are used (Porter & Teisberg, 2006). In addition this evidence suggests that hospital performance depends on factors other than the issue whether or not a hospital is focused or specialized and physician-owned or not (Carey et al., 2008). The mixed findings can also be explained in part by the lack of publicly available data to determine whether or not physicians are owners of a facility, making it not possible to directly identify physician-ownership. The reviewed studies used several proxy measures (i.e. volume of referrals, board membership, information on websites and listings) which complicates the systematic comparison of results.

Related to this is the fact that although physician-owners favor their own specialty hospital, they also refer patients to competitor hospitals in which the size of ownership appears to be an important factor, not the fact of ownership in itself (Greenwald et al. 2006).

Notwithstanding these issues the following findings are significant. Firstly, the reviewed studies show that procedure volume is an important aspect that cannot be neglected. Over the past decades numerous studies have described the relationship between the number of procedures performed and clinical effectiveness and safety (Barker et al. 2011). This issue lies at the center of our research question since the potential advantages in terms of cost and quality could result from the focus on a certain clinical area. However while a volume shift from full service-general hospitals to specialized facilities could be expected no clear

evidence of declines in full service-general hospital volume exists (Bian & Morrisey, 2007; Courtemanche & Plotzke, 2010; Hollingsworth et al., 2012). Secondly, when considering quality and cost of provided care it is important to note that specialized facilities have been found to treat more patients in better health (Hollingsworth et al., 2012), with less comorbid illness (Cram et al., 2009) and characterized by a lower severity of illness (Yee, 2011). This makes a valid and reliable comparison of quality of provided and clinical outcomes difficult. Considering the findings of our systematic review we note that previous research did not detect a fundamental cost or quality advantage in favor of ASCs and SHs. When quality of care is considered it is important to note that with respect to lower severity cases a limited difference in favor of specialized facilities was demonstrates (i.e. Cram et al, 2010; Hollingsworth et al, 2012). In contrast evidence suggests that specialized facilities might not do as well as full service-general hospitals with very sick patients (Greenwald et al, 2006).

In addition, even if we assume that specialized facilities outperform general full-service hospitals in the niche they focus on, we argue that the study of the feasibility of the business case of specialized facilities cannot neglect the impact on the delivery system already in place. Moreover it is equally important to reflect on the corresponding impact on the other services not provided by these focused factories. Since specialized facilities do not cover the whole scale of services, the question rises if the business case of general hospitals is still sustainable when high volumes of these procedures would shift away from full service-general hospitals towards specialized facilities (Lu et al., 2009; Hollingsworth et al., 2012). One element is that low-volume hospitals (below a certain threshold volume) could have inadequate experience with the procedures involved, leading to suboptimal clinical outcomes (Elixhauser, Steiner & Fraser, 2003). In light of this concern the question rises if full service-general hospitals will still be able to treat the more complex cases when the basic standardized medical workload shrinks down or even disappears. However, it should be noted that procedural volume of

hospitals does not reflect the number of procedures performed by a certain physician. Considering that most physicians practicing at specialized facilities also practice in a general hospital, this reduces the importance of this quality aspect.

Furthermore the rise of specialized facilities could have an important financial impact on full service-general hospitals (Carey et al., 2011; Schnieder et al., 2008; Simasi et al.; 2008). Firstly, this could lead to an increase of the cost of the delivered care because of the disadvantages in terms of cost-efficiency associated with a small volume of high complex cases. Secondly, general hospitals internally cross-subsidize highly necessary, but unprofitable, services such as emergency care with more profitable activities. This also enables them to provide care to the poor and underinsured. When profitable services are no longer performed at full service-general hospitals the question rises how these hospitals will cover the cost of this activity.

Finally, the impact of the physician-ownership status associated with specialtized facilities should be considered. A physician with an ownership stake in a specialized facility receives besides a professional fee, also a share of the facility fee paid to the specialized facility. This increases physicians' financial self-interest into decisions regarding patient care. In this respect, concerns about the possible supplier-induced demand and self-referral have been put forward (Greenwald et al., 2006; Gabel et al., 2008; Mitchel, 2008). Likewise physicians can maximize profits by treating patients for whom the profit margin is the highest in their specialized facility and refer financial unattractive patients to full service-general hospitals (cream skimming).

Overall, the evidence base does not show competitive advantages in terms of quality and cost of the delivered care in favor of specialized facilities. Since the volume of targeted procedures performed by specialized facilities has not implied an important decline in general hospitals' volume, the corresponding impact on general hospitals remains limited. However,

if volume of certain procedures should shift significantly towards specialized facilities this could to negative financial effects. Therefore, the development of specialized facilities and the corresponding impact on full service-general hospitals should be monitored carefully.

CONCLUSION

In this study we reviewed the evidence base of the physician-owned specialized facilities (SHs and ACSs) as focused factories. We examined the effects on the quality of provided care within these facilities and the corresponding impact on full service-general hospitals. Our results show that little evidence exists in support of a competitive advantage in favor of these specialized facilities. The findings of previous research are mixed and can be considered to be inconclusive. Moreover, the evidence suggests that comparing costs and quality of care delivery is highly complex and depends on factors other than the issue whether or not a hospital is focused and specialized or whether or not the hospital is physician-owned.

Furthermore, even if a competitive advantage should exist in favor of specialized facilities, it is equally important to reflect on the impact on the other services not provided by these focused factories. Full service-general hospitals internally cross-subsidize unprofitable services such as emergency care or highly complex cases. In addition, this enables them to provide care to the poor and underinsured. Since the volume of targeted procedures performed by specialized facilities has not implied an important decline in full service-general hospitals' volume, to date, the corresponding impact on full service-general hospitals remains limited. However, if volume of certain procedures should shift significantly towards specialized facilities this could undermine the business model of full service-general hospitals. Therefore, the development of specialized facilities and the corresponding impact on full service-general hospitals should be monitored carefully.

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FIGURE 1

Conceptual Framework

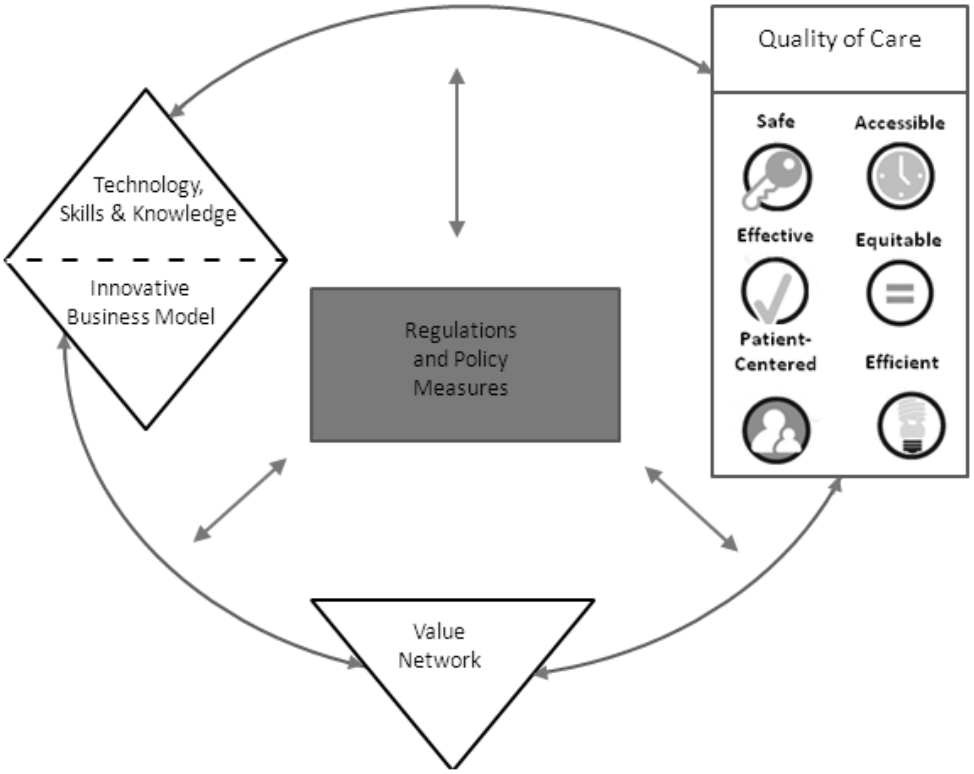

FIGURE 2
Flow Chart of Search Strategy

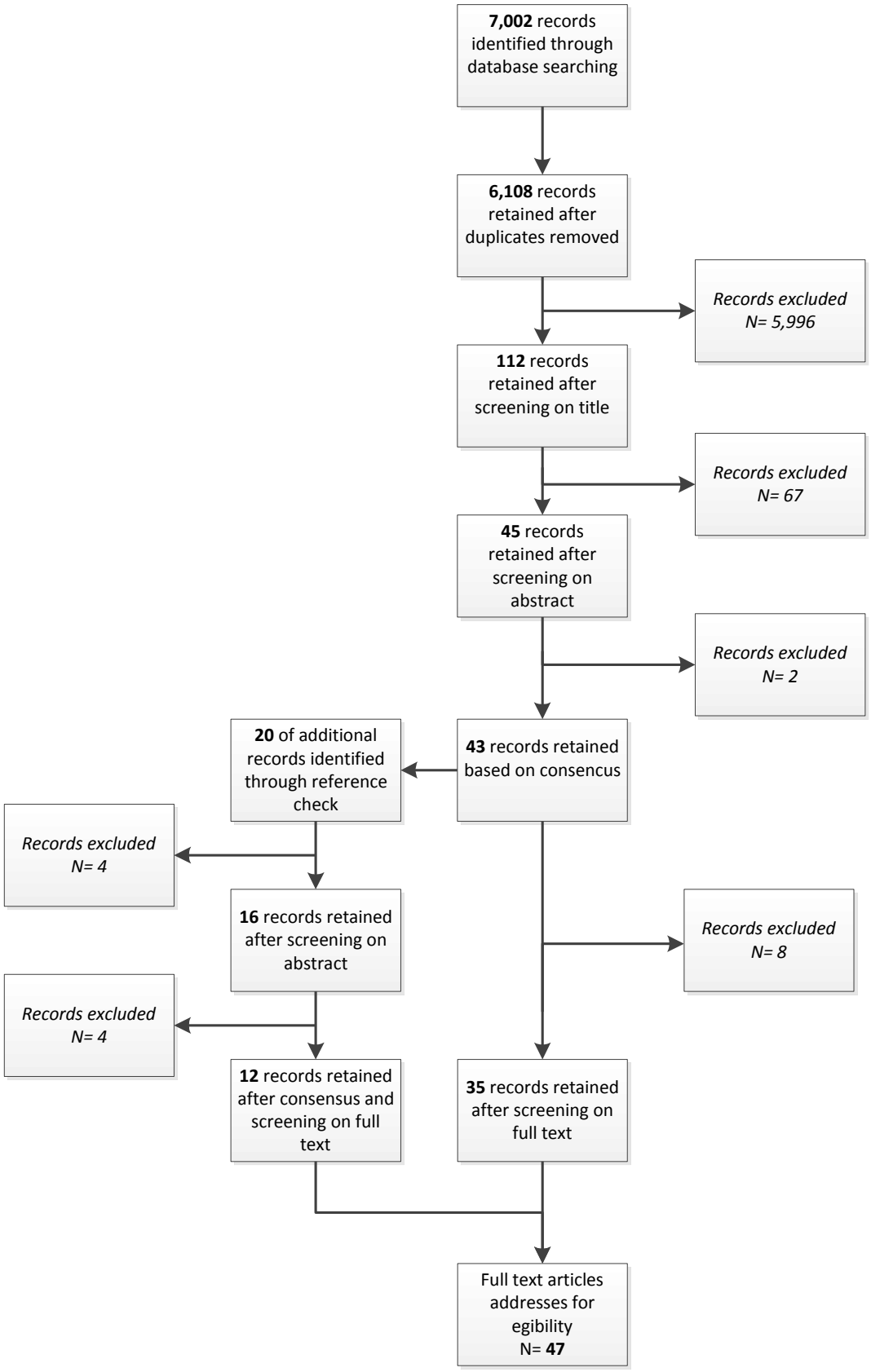

TABLE 1: Evaluative framework, exemplary outcomes and measurements

Theme	Definition	Exemplary outcomes	Exemplary measurements
Safe	Delivering health care which minimizes risks and harm to service users	Mortality rate Postoperative complications Unexpected complications	Likelihood of postoperative complications, likelihood of same day readmission (Hollingsworth et al., 2012). In-hospital mortality for coronary artery bypass grafting (Cram et al., 2009).
Effective	Delivering health care that is adherent to an evidence base and results in improved health outcomes for individuals and communities, based on need	Adherence to guidelines Evidence Based Medicine	Administration of ß-blockers on arrival and discharge for acute myocardial infarct (Popescu et al., 2008). Percutaneous coronary intervention indications for treated patients: documented angina, atypical chest pain or a positive stress test (Cram et al., 2012).
Patient-centered	Delivering health care which takes into account the preferences and aspirations of individual service users and the cultures of their communities	Patient satisfaction Quickly return patients to their Homes	Patient satisfaction (Andersen et al, 2010).
Accessible	Delivering health care that is timely, geographically reasonable, and provided in a setting where skills and	Waiting times Expected number of weeks-waiting time	Diagnosis-procedure time (Andersen et al, 2010).

	resources are appropriate to medical need		
Equitable	Delivering health care which does not vary in quality because of personal characteristics such as gender, race, ethnicity, geographical location, or socioeconomic status	Race Gender Uncompensated and charity care	Admitted Black patients for coronary revascularization (Brahmajee et al., 2008). Uncompensated and charity cardiac care performed (Carey et al., 2009)
Efficient	Delivering health care in a manner which maximizes resource use and avoids waste	Cost of care delivery	Peri-operative times (Hair et al., 2012).
Value Network	The coalescence of the existing value network around the new delivery model through which care is delivered. The added value for the entire system.	General Hospital Financial Health	General hospitals' offerings of services and growth in high-technology diagnostic imaging services in general (Carey, Burgess & Young, 2009). General Hospital Profitability (Plotzke & Courtemanche, 2011)

TABLE 2: List of criteria used for the quality assessment

Research Question	Well explained
Study Design	Appropriate to address the research question Cross-sectional or longitudinal Size and representativeness of the sample
Data Quality	Source of data mentioned Quality check reported Addressing confounders
Analysis	Methods clearly explained Appropriate statistics
Discussion	Internal Validity External Validity Conclusions supported by findings

TABLE 3: Basic characteristics and findings of included studies

Year	Reference	Quality appraisel	Topic	Clinical Field	Purpose	Outcome	Control / Secondary Measures	Findings
2010	Al-Amin & Housman	M	Value Network	Specialized Secondary Care	To examine competition between ASCs[1] and General Hospitals.	Organizational mortality	Market demand size, physician referral, type of facility	No evidence was found that hospitals exit markets with hig levels of competition. No evidence that ASC exit was affe by hospital density. ASC organizational mortality was negatively reflected by competition by another ASC in the market.
2010	Al-Amin, Zin, Rosko & Aaronson	M	Value Network	Cardiology , General Surgery, Orthopedics and Oncology	To investigate the relationship between general hospital closure rates and the market rate entry of SH[2].	General hospital closure rate	Environmental variables (population size, number of specialist physicians, expenditures per physician, state, unemployment rate), Insitutional variables (certificate of need program) and Ecological variables (general hospital closure rate, state level general hospital size).	Evidence was found that economic, supply, regulatory and financial conditions determined the founding rates of SH. S founding rates were related to general hospitals closure rat
2011	Andersen & Jakobsen	L	Effective Patient Centered Accessible	Orthopedics: Hip Operations	To determine if physician ownership influences professional behavior, treatment quality and patient satisfaction.	Patient satisfaction , clinical results (prophylactic antibiotic and thrombotic treatment, readmission within 30 days and 3 months, post-surgery complications), waiting time for primary hip replacement	Incentives (pay related to physician productivity), case-mix indicators for hip patients (comorbidity, primary arthritis, number of hips affected), patient selection , clinical procedures and non-clinical factors),	Evidence indicated that from a clinical perspective patients receive the same treatment. Efficiency (income/cost rate) w higher in specialized private hospitals than in public clinics Non-clinical factors such as waiting times are optimized, patient satisfaction was higher and fewer complication-pro patients were admitted to privately owned clinics. Private clinics pay greater attention to delivering services that are financially lucrative.
2011	Barker, Rosenthal & Cram	M	Safe	Cardiology: Cardiac Revascularization	To investigate the relationship between procedure volume and mortality at SHs and general hospitals.	Mortality (predicted from patient health)	Procedures volume, Hospital quality score (conformance to clinical guidelines), staffing rate, for-profit status, race, number of hospitals, 65+ population, expected hospital volume based on geographic distribution of patients	After correcting for the simultaneous relationships betwee procedure volume and mortality, specialty cardiac hospital have no mortality rate advantage over general hospitals wi the same procedure volume. Evidence was found that mortality rates influence the number of patients a hospital able to attract.
2006	Barro, Huckman & Kessler	H	Value Network Safe	Cardiology: Cardio-Vascular Illness	To determine the effect of cardiac SHs on cost and quality of medical care.	Hospital expenditures, use of intensive procedures, health outcomes (mortality and readmission)	Patient characteristics (age, gender, race, diagnosis, 180-day prior expenditure)	Markets experiencing entry by a cardiac specialty hospital have lower spending for cardiac care without significantly worse clinical outcomes (mortality and readmissions). Specialty hospitals tend to attract healthier patients and provide higher levels of intensive procedures. SHs choose enter markets with healthier patients, provide additional intensive treatments of questionable cost-effectiveness and treat healthier patients within markets.

[1] ASC: Ambulatory Surgery Center
[2] SH: Speciality Hospital/ Specialized Hospital

2007	Bian & Morrisey	M	Value Network	Specialized Secondary Care	To determine the association of free-standing ASCs with hospital surgery volume.	Hospital in-patient and out-patient surgical volume	Hospital concentration, HMO penetration, number of specialty surgeons per 10,000 population, nonfederal physicians / 10,000 population, per capita income, unemployment rates, proportion 64+ and total population in hospital area, year	ASCs were associated with a decrease in hospital outpatien volume. No effect on hospital inpatient procedures was fou Greater hospital concentration was associated with fewer outpatient and fewer inpatient procedures (limited effect).
2006	Bian & Morrisey	M	Value Network	Specialized Secondary Care	To determine market effects of health maintenance organization penetration and hospital competition on the growth of freestanding ASCs.	ASCs/10,000 population	Merger and closure information on ASC, HMO penetration, number of HMO enrollees, community hospital concentration, MSA-level covariates (per capita specialty surgeons, per capita non-Federal physicians, proportion 65+, per capita income, unemployment rate)	ASC are less likely to enter markets with greater HMO penetration and more likely to enter concentrated hospital markets (corresponding with a higher demand of specialize services).
2011	Carey, Burgess & Young	H	Value Network	Specialized Secondary Care	To examine the effects of ASC competition on general hospital financial performance.	Net patient revenue, total operating expenses (costs) and profit margins	Number of admissions, number of outpatient visits, number of outpatient surgeries, Length Of Stay, payer mix, inpatient case-mix index, input prices, number of staffed beds, general hospitals in the market, number of specialty hospitals entrants, type of SH, average profit margin in region, population growth, per capita physicians in region	The combined effects on revenue, cost and margin suggest that general hospitals were experiencing competition from ASCs. Cost reductions were insufficient to offset revenue losses, resulting in decreases in margins in hospitals with A competition.
2009	Carey, Burgess & Young (a)	M	Value Network	Cardiology, Orthopedics and General Surgery	To determine the effect of specialty hospital entry on changes in service provision by general hospitals.	Competition level of single specialty hospitals high technology, safety net	Case mix, per capita physicians, per capita income, hospital size and percentage of hospitals in the market	General hospitals are increasing their own offerings of services (cardiac surgery, free standing out-patient centers) that are in direct competition with those of SHs. Entry of S is also associated with higher growth in high-technology diagnostic imaging services in general hospitals
2009	Carey, Burgess & Young (b)	M	Value Network	Specialized Secondary Care	To determine the effect of SH entry on nurse staffing levels in general hospitals.	Nurse staffing level (FTE registered nurses and FTE licensed practical nurses)	Case mix, number of beds, profit status, public status, overall market competition, market share (nonprofit, public, teaching system hospitals)	SHs were not found to have higher nurse staffing ratios tha general hospitals. Hospitals located in markets with the presence of orthopedic/surgical SHs raised their nurse staff levels.
2009	Carey, Burgess & Young (c)	M	Equitable	Cardiology, Orthopedics and General Surgery	To determine changes in the provision of uncompensated and charity care in hospitals competing with ASC.	Costs of uncompensated care and charity care	Total number of beds, number of hospitals, number of ASC, overall market competition, per capita income, unemployment rates, occupancy rate, hospital ownership status	Results indicated that the effects of SHs entry on uncompensated care differed by specialization. No associa was found between orthopedic and surgical hospitals and uncompensated and charity care. Changes in uncompensat and charity cardiac care was characterized by an important downward effect (25.9 and 40.5 percent lower for hospitals markets with SHs).
2008	Carey, Burgess & Young	H	Efficient	Cardiology, orthopedics and general surgery	To perform a comparative cost analysis of full-service hospitals and ASCs.	Hospital total costs	Number of discharges, number of outpatient visits, average Length of stay, input price, case mix, patient safety indicators (infections due to medical care, postoperative hemorrhage or hematoma, accidental puncture or laceration), competition, ownership, system (multihospital system), teaching status, hospital size	No evidence was found that SHs were more efficient than service hospitals. Orthopedic and surgical SHs had significantly higher levels of cost-inefficiency. Cardiac hospitals did not appear to be different from their competit (in terms of cost-inefficiency).

2011	Chukmaitov, Devers, Harless, Menachemie, Brooks	H	Safe	2 Common Procedures: Arthroscopy and colonoscopy procedures	To examine the impact of ASC strategies and structures on their quality performance.	30-day unplanned readmissions	Number of practicing physicians, volume of services, percentage of specialization, ownership type, payer mix, severity of illness, overall market competition, race, gender, age year	A higher level of specialization and volume of procedures may be associated with a decrease in unplanned hospitalizations at ASC.
2008	Chukmaitov, Menachemi, Brown, Saunders & Brooks	H	Safe	12 (most common) Surgical Procedures (i.e. arthroscopy, biopsy of the liver, cataract removal, colonoscopy, debridement of skin or other tissues)	To compare quality outcomes of ASCs vs. Hospital based outpatient departments.	Risk-adjustment 7-day and 30-day mortality and 7-day and 30-day unexpected readmissions	Severity of illness, comorbidity	Neither ASC nor hospital based outpatient department performed better overall, but important variations for certa procedures were found. When risk-adjustment is applied f both primary and secondary diagnosis ASCs performed be for upper gastrointestinal endoscopy on 30-day mortality a hospital outpatient department performed better in all five procedures (colonoscopy, debridement of skin and other tissues, repair of inguinal hernia, laparoscopic occlusion ar fulguration of oviducts and spinal injection for myelograph and/or computed tomography) for 7-day and 30-day readmissions.
2008	Cimasi, Sharamitaro, Haynes & Seiler	M	Value Network	Specialized Secondary Care	To investigate the effect on profitability of short term general acute care hospitals after entry of ambulatory surgical area.	Profitability indicators: operating income to beds, operating income to discharges, net income to beds, net income to discharges	Year	No conclusive evidence was found that SHs negatively impact profitability of acute care hospitals.
2008	Courtemanche, Plotzke	H	Value Network	Specialized Secondary Care	To estimate the effect of ASC entry on hospital outpatient surgical volume.	Hospital outpatient surgical volume	Hospital size, private/public/teaching status, location, number of operating rooms, full time physicians and dentists, overall hospital competition, number of hospitals, number of ASC, population 65+, total population, insurance status, unemployment rate, median income, poverty	An influence of ASC entry on hospitals outpatient surgical volume was apparent if facilities are situated within a few miles of each other. This effect is stronger for large ASC a the first ASC to enter the market. The reduction in hospital volume is not nearly large enough to offset the new procedures performed by the entering ASC. No evidence w found that entering ASC reduce hospital inpatient surgical volume.
2011	Cram, House, Messenger, Piana, Horwitz & Spertus	H	Effective	Cardiology: Percutaneous Coronary Interventions	To investigate inappropriate use of PCI procedures.	Unclear indications of PCI (adherence to guidelines: without documented angina, typical of atypical chest pain or a positive stress test)	Type of hospital (not-for-profit, teaching , for-profit or specialty), geographic location, bed size, PCI volume, patient demographics (gender, race, admission source, insurance status, inpatient status), comorbidity (i.e. congestive heart failure, diabetes), clinical characteristics (i.e. ejection fraction, New York Heart Association class)	Specialty hospitals were found to perform somewhat more PCI for unclear indications. Wide variation across hospital existed.

2010	Cram, Bayman, Popescu & Vaughan-Sarrazin	H	Equitable Safe	Cardiology: Acute Myocardial Infarction, Coronary Artery Bypass Grafting	To compare characteristics and outcomes of patients hospitalized in specialty cardiac hospitals and general hospitals.	Differences in patient demographics, comorbidity, risk-standardized mortality	Race, gender	SH have a lower proportion of women and blacks and pati with less comorbid illness. In-hospital mortality in specialt hospital was lower than in general hospitals for acute myocardial infarction.
2007	Cram, Vaughan-Sarrazin & Rosenthal	H	Equitable	Orthopedic Surgery: Total Hip Replacement and Revision and Total Knee Replacement and Revision	To determine whether physician ownership versus non-ownership differ in hospital characteristics and patient population served.	Race (black or white patients), insurance status.	Procedural volumes, hospital teaching status, for profit status, severity, comorbid conditions, nurse staffing ratios	Patients who underwent major joint replacement in physici owned SHs were less likely to be black than patients in no physician owned SHs (although higher proportion of black neighborhood of physician-owned SHs). Patients treated in physician-owned SHs had lower rates of most common comorbid conditions (heart failure and obesity). Physician-owned SHs performed fewer major joint replacements on Medicare patients and were less affiliated with medical school.
2007	Cram, Vaughan-Sarrazin, Wolf, Katz & Rosenthal	H	Safe	Orthopedics: Total Hip Replacement, Total Knee Replacement and Revision of Total Knee Replacement	To compare patients characteristics and outcomes between specialty hospitals and general hospitals.	Outcomes occurring within 90 days of surgery (sepsis, hemorrhage, pulmonary embolism, deep vein thrombosis, wound infections requiring readmission or death), Length Of Stay and the proportion of patients requiring transfer to another acute care hospital	Demographic characteristics (age, gender, race and socioeconomic status), comorbidity, high-risk conditions and admission source	SHs had a greater mean procedural volume. After adjustme the composite outcome (the six described outcomes occurr within 90 days of surgery) was significant better in SHs compared to general hospitals.
2005	Cram, Rosenthal & Vaughan-Sarrazin	H	Safe	Cardiology: Percutaneous Coronary Intervention and Coronary Artery Bypass Grafting	To compare patients characteristics, hospital procedural volumes and patient outcomes between specialty hospitals and general hospitals.	Mortality rate	Demographic characteristics (age, gender, race), socio-economic status, comorbidity, admission source, surgical priority, age, volumes.	The mean volumes were higher in SH than general hospita After adjusting for patient characteristics the odds-ratio for death after percutaneous coronary intervention was similar both settings. The odds-ratio for death after coronary artery bypass grafting was lower in SH than in general hospitals. After adjusting for procedure volume no significant differences were found. Specialized hospitals treated healt patients.
2008	Gabel, Fahlman, Kang, Wozniak, Kletke & Hay	M	Equitable	General Surgery	To investigate the referral patterns by patient insurance (ASCs vs .hospital outpatient department).	Referral patterns of physicians by patient insurance status	Facility type, physician ownership status, patient characteristics (gender, age and race), discharge status (i.e. home), diagnosis, procedure, source of admission, referring physician, payer mix (self-pay, Medicaid, Medicare, commercial)	Physicians at physician-owned facilities were more likely t other physicians to refer well-insured patients to their facil and route Medicaid patients to hospital out-patient clinics.
2006	Greenwald, Cromwell, Adamache, Bernard, Drodz, Roor & Devers	M	Equitable Safety	Cardiac, Orthopedic and Surgical Procedures of Circulatory System, Muscoskeletal System, Connective Tissue and Surgical DRGs	To compare referral patterns, quality, patient satisfaction and community benefits of physician-owned specialty versus competitor hospitals.	Referral volume, patients preferences and service needs, severity of illness, mortality rates, readmissions and patient safety indicators	Participating in taking emergency call in competing community hospitals,	From the analysis, it was found that ownership by physicia is positively related to the likelihood of referring patients t specialty hospital. Physicians at physician-owned facilities more likely than other physicians to refer well-insured pati to their facilities and threat a healthier population. SH prov generally high-quality care to satisfied patients, but provid less uncompensated care in specialty hospitals.

2012	Hair, Hussey & Wynn	L	Efficient	Procedures of the Nervous -, Eye -, Cardiovascular -, Digestive -, Musculoskeletal -, Integumentary System and Miscellaneous Diagnostic and Therapeutic Procedures	To compare ASCs to hospitals by efficiency measures.	Time in surgery, time in operating room, time in postoperative care, total perioperative time	Age, gender, number of diagnoses, symptoms related to surgery (hypertension, nausea, ..), use of anesthetics	The mean total time was shorter for most categories in free standing ASCs. For eye, cardiovascular system and local excisions this was not the case. The mean time was shorter freestanding ASCs than hospital-based ASCs across 3 subperiods of time: surgery time, operating time and postoperative time. No differences in patient age, gender, symptoms related to the surgery were found.
2010	Hollenbeck, Hollingsworth, Dunn, Ye & Birkmeyer	H	Effective	4 Common Procedures: Knee Arthroscopy, Cystoscopy, Cataract Removal, Coloscopy	To determine the relationship between ASC market share and rates of procedure.	Procedures rate (number of patients)	Age, gender, race, insurance status, socioeconomic status, comorbidity, ASC market share	For all 4 procedures, adjusted rates of procedures performe were significantly higher in hospital service areas with hig market share for ASC. The greatest difference was found i patients undergoing cystoscopy. The age-adjusted rate of cystoscopy was nearly 3-fold higher than in areas with low ASC market share.
2012	Hollingsworth, Krein, Birkmeyer, Ye, Kim, Zhang & Hollenbeck	H	Value Network	Urology: Stone Surgery	To determine how the opening of ACS impacts stone surgery use in health care market and asses the effects of its opening on the patient mix by nearby hospitals.	Stone surgery use (relative value unit and annual hospital service area level rate of stone surgery/population in hospital service area)	Age, gender, race, primary payer, socioeconomic status, comorbidity status and multiple ASCs in hospital service area.	No evidence of procedure off-loading from competing hospitals to ASC was found. ASC opening is associated w increased market level stone surgery use. Four years after opening the relative increase in the stone surgery rate was higher (64%) in hospital service areas where a center open vs. hospital service areas without a center. These market le increases in surgery were not associated with decreased surgical volume at competing hospitals and the absolute change in patient disease severity treated at nearby hospita was small.
2012	Hollingsworth, Saigal, Lai, Dunn, Strope & Hollenbeck	H	Safe Equitable	Urologic Surgery (i.e. prostate biopsy, urethra dilation, endoscopic bladder)	To compare quality of surgical care between hospitals and ASC.	Adverse events: 30-day mortality, unexpected readmission rate(same day and 30 days), postoperative complications	Case mix, age, gender, race, comorbid status, area of residence	A substantial increase in frequency of non-hospital based outpatient surgery. Compared to hospitals ASC treated mo men and healthier patients. Fewer postoperative complications, a higher likelihood of same day readmissio following surgery at ASC was apparent. The probability of any adverse event was considered low across all ambulato settings.
2011	Hollingsworth, Krein, Ye, Kim & Hollenbeck	H	Effective	4 Common Procedures: Cataract Surgery, Colonoscopy, Upper Gastro-Intestinaltract Endocopy, Cancer-directed Breast Surgery	To determine the impact of the opening of an ASC in a health market on the rates of procedure performed.	Annual surgical volumes	Age, gender, race, year, presence of multiple ASCs within hospital service area, comorbidity, socio-economic status, insurance status	The opening of an ASC is associated with increase in population based rates of colonoscopy and upper gastrointestinal tract endoscopy. Rates of cancer directed breast surgery remained flat over time. Among hospital service areas where an ASC opened, the relative increases colonoscopy and upper GI tract endoscopy use were approximately 117% and 93% higher, respectively, 4 years after the opening compared with hospital service areas wit ASCs.

2010	Hollingsworth, Ye, Strope, Krein, Hollenbeck & Hollenbeck	H	Effective	5 Common Procedures: Carpal Tunnel Release, Cataract Excision, Myringotopy with Tympanostomy Tube Placement, Colonoscopy, Knee Arthroscopy	To determine the association between physician ownership and surgical volume.	Surgical volume (differences in annual case loads and changes in annual case load)	Differences in patient mix, patients by treatment site, insurance status, comorbidity	A significant association between physician-ownership of surgicenters and greater use of the five common outpatient procedures (carpal tunnel release, cataract excision, myringotopy with tympanostomy tube placement, colonoscopy, knee arthroscopy) was found.
2009	Hollingsworth, Ye, Strope, Krein, Hollenbeck & Hollenbeck	M	Value Network	Urology: Urinary Stone Surgery (Percutaneous Nephrolithotomy, Shockwave Litothripsy, Ureteroscopy, Conventional Extraction, Ancillary Procedures)	To understand how physician ownership of ASCs relates to surgery volume of urinary stones.	Procedural volume of urologist (in ASC and total)	Patient age, gender, race, primary payer, socioeconomic status, level of comorbidity, year	A significant association between physician-ownership of ACSs and increased surgery use was apparent. Owners performed a greater proportion of their surgeries in ASCs t non-owners, and their utilization rates were over twofold higher. For every 10 percent increase in the penetration of owners within a urologist's local healthcare market, the an caseload increased by 3.32.
2009	Lu, Hagen, Vaughan-Sarrazin & Cram	M	Value Network	Orthopedics: Total Hip Arthroplasty and Total Knee Arthroplasty	To examine the impact of newly opened physician-owned specialty hospitals on competing general hospitals (volume and case complexity).	Surgical volume, patient case complexity	Patient demographics, comorbid illnesses, high-risk orthopaedic conditions and individual hospitals	No clear evidence that entry of physician-owned specialty orthopaedic hospitals resulted in declines in total hip arthroscopy or total knee arthropscopy volume or increases patient case complexity for the competing general hospita
2012	Meyerhoefer, Colby & McFetridge	H	Safe value Network	4 Common Procedures: Colonoscopy, Hernia Repair, Knee arthroscopy, Cataract repair	To asses patient selection across ASC and hospital outpatient departments.	Patient illness severity, cost risk	Age, gender, ethnicity, payer type, procedure volume (physician and facility), market conditions (ASC market penetration) and patient demographics	ASC benefit from positive selection. The degree of selecti varies by surgery type and patient population. ASC experienced a significant degree of positive selection amor hernia patients, moderate degree on knee arthroscopy and colonoscopy and a limited degree among cataract patients.
2012	Mitchell	L	Effective	Urology: Prostate Biopsy	To determine how ownership of in-office ancillary services affects the use of surgical pathology services and cancer detection rates.	Billing for specimen per biopsy, cancer detection rate	Year, region, gender, comorbid conditions and race	Self-referring urologists billed more specimens with patho tissue cores per prostate biopsy than non-self-referring urologists. However, lower cancer detection rate are linked self-referring urologists.

2010	Mitchell	M	Effective	Orthopedics: Carpal Tunnel Repair, Rotator Cuff Repair, Arthroscopic Knee Surgery	To evaluate if financial incentives linked to physician ownership influence frequency of outpatient orthopedic surgical procedures.	Frequency of use (number of patients treated by procedure/number of patients with such diagnosis)	Age, gender, year, physician ownership	Age- and sex-adjusted odds ratios indicate that the likeliho of having carpal tunnel repair was 54% to 129% higher for patients of surgeon owners compared with surgeon non-owners. For rotator cuff repair, the adjusted odds ratios of having surgery were 33% to 100% higher for patients treat by physician owners. The age and sex-adjusted probability arthroscopic surgery was 27% to 78% higher for patients o surgeon owners compared with surgeon non-owners. High use rates by physician owners across time suggests that financial incentives linked to ownership of either specialty hospitals or ambulatory surgery centers influence physicia practice patterns.
2008	Mitchell	L	Effective	Back and Spine Disorders	To compare practice patterns for physician owners and non-owners.	Practice patterns: frequency of use of surgery, diagnostic and ancillary services (i.e. simple and complex spinal fusion, MRI, Epidurals, physical therapy..)	None	Findings suggest the introduction of financial incentives linked to ownership coincided with a change in the practic patterns of physician owners. These changes were not evid among physician non-owners. The frequency of use of surgery, diagnostic and ancillary services increased significantly after physician established ownership in a SH
2007	Mitchell	M	Effective	Spinal Fusion Procedures (Simple and Complex)	To compare the utilization rate of spinal fusion in two markets.	Utilization rate (complex and simple) spinal fusion per 1000 back-spine cases in treatment.	None	The entry of SHs was followed by substantial increases in market area utilization rates for complex spinal surgery. Su changes did not occur in another region where physician-owned SHs do not exist. For simple spinal surgery this was the case.
2005	Mitchell	H	Value Network Equitable Safe	Cardiac surgery	To compare practice patterns of physician-owners of limited service cardiac hospitals and physician non-owners at competing full-service community hospitals.	Volumes of cases and severity of illness of case mix	Payer mix (DRG cases treated each year with different types of insurance coverage	Physician-owners treated higher volumes of profitable card surgical DRGs, higher percentages of low-severity cases a higher percentages of cases with generous insurance comp with physician non-owners.
2008	Nallamothu, Lu, Vaughan-Sarrazin & Cram	H	Equitable	Cardiology: Coronary Revascularization (Coronary Artery Bypass Grafting, Percutaneous Coronary Intervention)	To examine whether black patients were less likely to undergo coronary revascularization at cardiac hospitals compared to white patients.	Patient characteristics (gender, race, age)	Geographic proximity to the nearest hospital, procedural acuity, comorbidities, admission type (elective, urgent, emergent) and admission source.	Black patients were less likely to be admitted at cardiac hospitals for coronary artery bypass grafting and percutane coronary intervention. However, this relationship was substantially attenuated if patients lived in close proximity cardiac hospitals.

2007	Nallamothu, Rogers, Chernew, Krumholz, Eagle & Birkmeyer	H	Effective	Cardiology: Coronary Artery Bypass Graft and Percutaneous Coronary Intervention	To determine whether the opening of cardiac hospitals was associated with increased population-based rates of coronary revascularization.	Rates of change in population based weights of revascularization (year).	Age, gender, race, US region, baseline year, presence of multiple new programs within hospital referral region, socio-economic status of hospital referral region	The opening of cardiac hospitals within an hospital referra region is associated with increased population-based rates coronary revascularization. These findings are consistent when rates for coronary bypass grafting and percutaneous coronary intervention were considered separately. For PCI this growth appeared largely driven by increased utilizatio among patients without acute myocardial infarction.
2011	Plotzke & Courtemanche	H	Value Network	General outpatient Surgery (divided in 13 categories: nervous system, eye, ear, nose/mouth, respiratory system, cardiovascular system, digestive system, urinary system, male and female genital system, musculokeletal system, integumentary an miscellaneous procedures)	To investigate whether the profitability of patients has an impact on the setting where the surgery is performed by a physician?	Procedure profitability	Gender, age, health status (measured by number of diagnoses), procedure complexity (measured by general anesthesia (dummy) and multiple procedures), insurance status, surgery type	Higher profit surgeries have a higher probability of being performed at an ASC compared to a hospital. After control for surgery type, a 10% increase in surgery's profitability is associated with a 1.2 to 1.4 percentage point increase in th probability the surgery is performed at an ASC.
2008	Popescu, Nallamothu, Vaughan-Sarrazin & Cram	M	Effective	Cardiology: Acute Myocardial Infarction and Heart Failure	To compare quality of care between specialty cardiac hospitals, competing general hospitals and top-ranked cardiac hospitals.	Compliance to treatment guidelines (evidence based quality measures: administrating Asperin, β-Blocker, Angiotensin-converting enzyme inhibitor; left ventricular function and composite measures)	None	Compliance to performance indicators in SH is similar to other hospitals. Quality of care appears to be slightly bette top-ranked cardiac hospitals but the overall performance o hospitals was relatively high.

2007	Schneider, Ohsfeldt, Morrisey, Li, Miller & Zelner	H	Value Network	General Surgery, Orthopedic Surgery, Cardiac Surgery	To determine if the presence of SHs in the market affect general hospitals' financial performance.	Hospital patient care revenue, patient care cost, patient care operating margins	Hospital size, mean length of stay, teaching status, mean cost/case, ownership status, discharges, % Medicare and Medicaid, case mix, staffing level (general, RNs, MDs), occupancy rate, outpatient visits, wage nurses, per capita income, population density, unemployment rate, number of specialty hospitals (new and established), number of physicians	Presence of SHs is associated with higher general hospitals patient care margins and lower patient care operating costs No difference was found for hospital patient care revenue.
2006	Stensland & Winter	L	Effective	Cardiology: Heart Hospitals	To determine whether physicians investment in heart hospitals was followed by an increase in the number of relatively profitable cardiac surgeries and/or in a shift towards operating on healthier patients.	Number of high-margin services (coronary bypass grafting), moderate margin surgery (acute myocardial infarction) and low margin surgery (implantation of cardioverter-derillators) performed and severity of patients treated at both types of hospitals	None	Although markets with physician owned SHs had slightly above-average growth rates in profitable cardiac surgeries, was only statistically significant for bypass surgery. There no increase in surgeries performed on healthier patients.
2009	Strope, Diagnault, Hollingsworth, Ze, Wei & Hollenbeck	M	Value Network	87 Procedures of the Genitourinary System (i.e. cystoscopy)	To evaluate the relationship between ownership and use of ASCs (procedure volume and share of financial lucrative procedures).	Rates of ambulatory surgery	Ownership status, financial incentives and location of practice	In general, rates of ambulatory surgery increased. This was primarily the case in ASCs (in contrast to hospitals). Physi ownership was associated with this increased use. The sha financially lucrative procedures increased more when ownership was present.
2011	Tan, Wolf, Hollenbeck, Ye & Hollingsworth	M	Equitable	Urology: Uretroscopy	To determine ureteroscopy rates decreased following the expansion of lithotriper ownership.	Use of ureteroscopy (number of procedures/population)	Comorbidity, age , gender, race, socio-economic status and primary payer	The introduction of physician ownership was not associate with increased or decreased rates of uretroscopy but might have influenced treatment selection among certain patient groups. After ownership expansion patients who underwer uretroscopy were older, sicker, less likely to be white or to have private health insurance.
2003	Winter	M	Safe	Cataract and Eye Procedures, Colonoscopy, Cystoscopy, Endoscopy, Interventional Pain Management Procedures, Arthroscopy, Ambulatory Musculoskelatal and Ambulatory Skin Procedures	To compare the medical complexity of patients treated in ASCs and outpatient departments.	Medical complexity (risk score)	Age, gender, diagnosis, setting (inpatient, outpatient and physician visits)	In each procedure category, patients in ASCs had lower average risk scores than those treated in outpatient departments.

2011	Yee	H	Effective	Colonoscopy	To investigate physician ownership of ASC on procedure volume and referral behavior.	Physician procedure volume, referrals	Patient health risk score	Physician board membership had a significant impact on physicians medical decisions and overall utilization of ASC Specifically, physicians who were member of the board ha increased procedure volume and refer and treat more lowe risk patients.